Abstracts of Technical Articles from Bell System Sources

Some Methods for Making Resonant Circuit Response and Impedance Calculations.[1] H. T. BUDENBOM. This article presents a series of short-cut methods for the computation of the amplitude and phase-response characteristics of one- and two-mesh circuits; the extension of the method to three- and four-mesh networks is carried out formally. It also treats the impedance-frequency characteristics of singly resonant circuits. The plan of attack in the single-circuit impedance and multi-mesh response cases is to express the desired circuit or transfer impedance as a polar numeric multiplied by a sizing constant which turns out to be a simple reactance element of the circuit.

A Rapid Method for the Determination of Sulfur in Ferromagnetic Alloys.[2] B. L. CLARKE, L. A. WOOTEN, and C. H. POTTENGER. A method is described for the determination of sulfur in ferrous alloys of high-nickel content, wherein the sample is heated in hydrogen at 1100° to 1200° C., and the liberated hydrogen sulfide absorbed in ammoniacal cadmium nitrate solution. The method is generally applicable to iron-nickel-cobalt alloys.

The precision of the method for the range of 0.005 to 0.020 per cent sulfur is shown to be ± 0.001 per cent sulfur on the basis of a 10-gram sample.

The Newly Discovered Elementary Particles.[3] KARL K. DARROW. During the three years following the discovery of heavy hydrogen in the latter part of 1931, four additional elementary particles of matter lighter than the alpha particle (nucleus of the ordinary helium atom) have been discovered where only two were known previously. This is considered extraordinary even for the present rapid pace of physics which sometimes requires physicists to revise their fundamental concepts of matter almost overnight. These five newly discovered particles formed the subject matter of a highly interesting and instructive address delivered recently by Doctor Darrow at a meeting of the American Institute of Electrical Engineers' New York Section; the essential substance of this illuminating address is presented in the published article.

[1] *Radio Engg.*, August, 1935.
[2] *Indus. & Engg. Chem.*, Analytical Edition, July 15, 1935.
[3] *Elec. Engg.*, August, 1935.

Magnetic Hysteresis at Low Flux Densities.[4] W. B. Ellwood. The energy loss per cycle in a ferromagnetic material subjected to small alternating fields is sometimes separated into three parts: the first due to eddy current loss, the second to hysteresis presumed to follow Rayleigh's laws at these flux densities; the origin of the remainder is unknown and is the subject of much controversy; it has been variously termed "magnetic viscosity," "after effect," and "square law hysteresis." In studying energy loss in a ring of compressed iron dust, hysteresis loops have been measured ballistically by a new method with a relative error in B_m as low as 0.01 per cent. The range in maximum flux density is from 2 to 100 gauss. The loops are lenticular and very slender, B_m being about 1500 times the remanence for the smallest loop. The smaller loops are at flux densities considerably below those investigated by Rayleigh. His findings as to variation of area, of remanence, and of permeability with loop amplitude are confirmed and extended through the new range of flux densities, though the shape of the loops is not as simple as that he proposed. The energy loss per cycle is proportional to $B_m{}^3$ while the remanence is proportional to $B_m{}^2$. The ballistic measurements have been compared with a-c. bridge measurements on the same specimen. The loss of unknown origin is not included in the hysteresis loss measured ballistically. Comparison is made between the third harmonic induced voltage computed by a Fourier series analysis of the ballistic loops and the harmonic actually generated by the specimen. Agreement is found between the measured and the computed values. Possible explanations of the discrepancy between the ballistic observed energy losses and a-c. findings are discussed.

A Fugue in Cycles and Bels.[5] John Mills. Engineers who are questioned by their musical acquaintances about electrical transmission and what it is likely to do to the art are likely to find an explanation, even in the simplest of terms, shooting over the heads of their audience. The reason lies not in the inherent difficulty of the concepts, but in their number, which exceeds the power of memory to retain as unrelated facts. In this volume John Mills has strung his facts together on the thread of logical relationship, but he has tied them into his readers' existing knowledge by many a deft touch of anecdote or humor. Frequency, with its relation to harmony and discord, opens the volume; there follows a physical picture of vibrations in various media and how one form is transformed into another. Pitch and intensity are next considered. An entire section is devoted to tele-

[4] *Physics*, July, 1935.
[5] Published by D. Van Nostrand Company, Inc., New York, N. Y., 1935.

phonic studies of hearing; it includes such topics as the ear, the amplifier, transmission, loudness, overloading and distortion.

A third section, which discusses the electrical future for music, will most intrigue the musician. After surveying the present state of the art of pick-up, transmission, recording and reproduction of music, the author visualizes some of the possibilities which might be most immediately realized: reproduction in auditory perspective, electrical music and electrical aids in teaching.

To permit a rapid survey by the general reader, Mr. Mills has withdrawn all tables and graphs from the main text and has grouped them, with necessary explanations, at the end. This section forms a useful compendium of numerical information on frequencies, decibels, thresholds, response curves of microphones and loud speakers, loudness and energy levels, masking and the like.

The engineer will find "A Fugue in Cycles and Bels" interesting and easy to read, and a source of data not always available, and he can recommend it to those musicians whose serious interest in their art leads them to delve into its physical basis.

Influence of Experimental Technique on the Measurement of Differential Intensity Sensitivity of the Ear.[6] H. C. MONTGOMERY. The lack of agreement among previous measurements of differential intensity sensitivity indicates that the values obtained depend to a large extent on the experimental conditions. The relative importance of various factors is indicated, and a procedure is suggested which was designed to give the smallest possible values of differential intensity sensitivity. Intensive measurements made by this method upon a single subject, using a pure tone of 1000 cycles, gave values consistently smaller than any previously reported. There is no sharp division between intensity changes which can be perceived and those which cannot. The response of the subject is essentially variable and can be described only by statistical methods.

Diurnal and Seasonal Variations in the Ionosphere During the Years 1933 and 1934.[7] J. P. SCHAFER and W. M. GOODALL. The most important results of daily ionospheric measurements made at Deal, New Jersey, latitude 40° 15′ N., longitude 74° 02′ W., over the period from March, 1933, to May, 1934, are given in this paper and may be summarized as follows:

1. There was a definite correlation between the noon value of ionic density of the F_1 region and magnetic disturbances, a decrease in ionic density being obtained on magnetically disturbed days.

[6] *Jour. Acous. Soc. Amer.*, July, 1935.
[7] *Proc. I. R. E.*, June, 1935.

2. The noon value of ionic density of the E and F_1 region attained a maximum in summer and a minimum in winter whereas the reverse condition, of minimum in summer and maximum in winter, was found for the F_2 region.

3. The time of maximum ionic density of the F_2 region varied with the seasons of the year, occurring near noon in winter and near sunset in summer.

The paper also shows a series of virtual height contour maps for the four seasons of the year.

Utilization of Electrical Resistance Measurements for Controlling the Composition of Alloys.[8] E. E. SCHUMACHER and L. FERGUSON. To stimulate interest in the more general use of the electrical resistance of solid solutions for indicating the composition of alloys, details concerning one application are set forth in this paper. While for other systems certain elements of the method as outlined here might have to be modified, it appears that the general principle could be advantageously utilized in many instances. This paper presents, therefore, a practical resistance method of supplementing ordinary chemical analyses in the determination of the antimony content of lead-antimony alloys ranging at least from 0.4 to 1.1 per cent. It has been found that, within this range, a 1 per cent change in resistance is produced by a change in antimony content of less than 0.1 per cent and that the maximum deviation in resistance data may reasonably be made so small as to correspond to not more than $\pm$ 0.01 per cent antimony.

[8] *Metals and Alloys*, June, 1935.